



Docket No.: 050395-0028

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer Number: 20277
Masuhiko NATSUHARA, et al.	:	Confirmation Number: 3109
Application No.: 09/339,826	:	Group Art Unit: 1755
Filed: June 25, 1999	:	Examiner: Karl E. Group
For: CERAMIC BASE MATERIAL	:	

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Masuhiko Natsuhara, hereby declare and say as follows:

1. I am the first named inventor of the above identified application and a person having ordinary skill in the art as evidenced by my attached *Curriculum Vitae*.
2. At my direction and under my supervision, the testing reported herein was conducted.
3. Samples 30 to 32 include a porous boron nitride (BN) sheet that was used as a setter having a thickness of 0.5 mm for sintering an aluminum nitride (AlN) ceramic base material, which includes an AlN powder having an average particle diameter of 1 μm and a sintering agent of Y_2O_3 powder having an average particle diameter of 0.6 μm . Samples 33 to 35 include porous carbon that was used as a setter for sintering an AlN ceramic base material, which includes an AlN powder having an average particle diameter of 1 μm and a sintering agent of Y_2O_3 powder having an average particle diameter of 0.6 μm . Table 1a shows the combination and weight ratios of powders for individual samples.

4. As comparative examples, Sample 36 includes dense glassy carbon that was used as a setter for sintering an AlN ceramic base material, which includes an AlN powder having an average particle diameter of $1\ \mu\text{m}$ and a sintering agent of Y_2O_3 powder having an average particle diameter of $0.6\ \mu\text{m}$, and Sample 37 includes dense BN that was used as a setter for sintering an AlN ceramic base material, which includes an AlN powder having an average particle diameter of $1\ \mu\text{m}$ and a sintering agent of Y_2O_3 powder having an average particle diameter of $0.6\ \mu\text{m}$.

5. The samples were heat-treated at 850°C for an hour in a non-oxidative atmosphere.

6. After the heat treatment, the magnitude of distortion (warp) and increment in the warp were measured for the sintered bodies in accordance with the method described in the specification at page 13, line 22 – pg. 14, line 17 and in Fig. 1.

7. The warp after sintering ranged from 8.4×10^{-2} to $9.1 \times 10^{-2}\ \mu\text{m}/\text{mm}$ for Samples Nos. 30-32. The warp after sintering for Sample Nos. 33-35 ranged from 8.2×10^{-2} to $9.0 \times 10^{-2}\ \mu\text{m}/\text{mm}$. The warp after sintering for Comparative Sample No. 36 was $10.8 \times 10^{-2}\ \mu\text{m}/\text{mm}$ and for Comparative Sample No. 37 was $11.2 \times 10^{-2}\ \mu\text{m}/\text{mm}$. The values for the warp after sintering for Samples Nos. 30-37 are shown in Table 2a.

8. The increment in the warp after heat treatment for Samples Nos. 30-32 ranged from $0.9 \times 10^{-2}\ \mu\text{m}/\text{mm}$ to $1.2 \times 10^{-2}\ \mu\text{m}/\text{mm}$. The increment in warp for Samples Nos. 33-35 ranged from $1.0 \times 10^{-2}\ \mu\text{m}/\text{mm}$ to $1.2 \times 10^{-2}\ \mu\text{m}/\text{mm}$. The increment in warp for Comparative Sample No. 36 was $6.3 \times 10^{-2}\ \mu\text{m}/\text{mm}$ and for Comparative Sample No. 37 was $6.5 \times 10^{-2}\ \mu\text{m}/\text{mm}$. The values for the increment in the warp after heat treatment for Samples Nos. 30-37 are also provided in Table 2a.

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9. The increment in the warp after the heat treatment becomes larger when the material of the setter is denser.

10. The undersigned hereby declares that all statements made herein based upon knowledge are true, and that all statements made based upon information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Jan. 11, 2008

Date

Masuhiko Natsuhara

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Table 1a

Sample No.	Combination and weight ratios of powders (wt.%)						Charging method for sintering		Sintering atmosphere and temperature		
	AlN	Si ₃ N ₄	Y ₂ O ₃	CaO	Nd ₂ O ₃	Yb ₂ O ₃	Setter		Gas	r (%)	Temperature (°C)
							Material and type	Rmax (μm)			
30	95.0	-	5.0	-	-	-	BN sheet	5	N ₂	15	1850
31	99.0	-	1.0	-	-	-	BN sheet	5	N ₂	15	1850
32	99.5	-	0.5	-	-	-	BN sheet	5	N ₂	15	1850
33	95.0	-	5.0	-	-	-	Porous Carbon	4	N ₂	15	1850
34	99.0	-	1.0	-	-	-	Porous Carbon	4	N ₂	15	1850
35	99.5	-	0.5	-	-	-	Porous Carbon	4	N ₂	15	1850
36	95.0	-	5.0	-	-	-	Glassy Carbon	4	N ₂	15	1850
37	95.0	-	5.0	-	-	-	Dense BN	4	N ₂	15	1850

Table 2a

Sample No.	Quantity ratio of sintering agents between the two surfaces of sintered body (a/b)	Warp after the sintering (μm/mm)	Increment in the warp after heat treatment (μm/mm)
30	1.10	8.4×10^{-2}	1.2×10^{-2}
31	1.15	8.6×10^{-2}	1.1×10^{-2}
32	1.21	9.1×10^{-2}	0.9×10^{-2}
33	1.08	8.2×10^{-2}	1.2×10^{-2}
34	1.13	8.5×10^{-2}	1.1×10^{-2}
35	1.20	9.0×10^{-2}	1.0×10^{-2}
36	1.42	10.8×10^{-2}	6.3×10^{-2}
37	1.45	11.2×10^{-2}	6.5×10^{-2}

Note: Sample Nos. 36 and 37 are comparative examples.



Curriculum Vitae

Name: Masuhiro Natsuhara

Date of birth: September 9, 1965

Place of birth: Osaka, Japan

Bachelor's Degree of Chemical Engineering of Tokyo Institute of Technology:
March 1989.

Master's Degree of Materials Chemistry Engineering of Tokyo Institute of
Technology: March 1991

Engineer of Research and Development of AlN Metalization and AlN Heater
for Laser Printer in Sumitomo Electric Industries: April 1991 – September
2000

Engineer of Research and Development of AlN Susceptor in Sumitomo
Electric Industries: October 2000 - Present